Greater Flamingo *Phoenicopterus roseus* breeding attempts on the Hauts Plateaux and in the Algerian Sahara, in 2011–13

Amel Mesbah[a], Nacera Bouchibi Baaziz[a,b], Nasser Baaziz[a,b], Mouloud Boulkhssaim[a,c], Abdelhakim Bouzid[a,d], Abdallah Ouldjaoui[a,c], Abdennour Boucheker[a,e], Riad Nedjah[a], Laïd Touati[a,b], Farrah Samraoui[a] and Boudjéma Samraoui[a,f]

Tentatives de reproduction du Flamant rose *Phoenicopterus roseus* sur les Hauts Plateaux et au Sahara algérien en 2011–13. En 2011, le Flamant rose *Phoenicopterus roseus* s'est reproduit avec succès dans deux sites algériens. A Safioune, au Sahara, la reproduction a commencé au début du mois de janvier et a concerné 1.500 couples. C'est la première fois que l'espèce se reproduit sur ce site, avec l'envol de 600 poussins, malgré une intrusion par des chacals qui provoqua l'interruption de la reproduction. Un total de 62 poussins fut bagué. A Ezzemoul, sur les Hauts Plateaux, la reproduction débuta fin mai et concerna 4.500 couples, avec l'envol de 3.600 poussins dont 895 furent bagués. La reproduction à El Goléa et Bazer Sakra connut un échec, malgré l'utilisation de modèles en bois de flamants roses et de nids en ciment pour attirer des couples nicheurs. En 2012 et 2013, la sécheresse ne permit pas la reproduction dans aucun des sites de nidification connus. Un nouveau site de nidification a été découvert en 2012 à Chott Chergui, sur les Hauts Plateaux de l'ouest algérien.

Summary. In 2011, Greater Flamingo *Phoenicopterus roseus* successfully bred at two sites in Algeria. At Safioune, in the Sahara, breeding started in early January and involved 1,500 pairs. It was the first time the species bred at this site and 600 chicks fledged, despite an intrusion by jackals, which caused the cessation of breeding; 62 chicks were ringed. At Ezzemoul, on the Hauts Plateaux, breeding started in late May and involved 4,500 pairs; 3,500 chicks fledged, of which 895 were ringed. Nesting was unsuccessful at El Goléa and Bazer Sakra, where decoys of adult flamingos and nest mounds were used to attract nesting pairs. In 2012 and 2013, drought prevented successful breeding of Greater Flamingos at all known nesting sites. A new nesting site at Chott Chergui, on the western Hauts Plateaux, was discovered in 2012.

Although Greater Flamingos *Phoenicopterus roseus* must have bred in North Africa for millennia, until recently, only sporadic breeding events have been documented and very little is known of its breeding ecology in the region (Johnson & Cézilly 2007). In Algeria, successful breeding was first recorded in 2005 at Ezzemoul (Samraoui *et al.* 2006) and, subsequently, a second breeding site was located at El Goléa, in the Sahara (Bouzid *et al.* 2009). In 2003–12, 23 nesting attempts were made at five sites, with breeding proven on four occasions (Samraoui *et al.* 2010, Bouchibi Baaziz *et al.* 2010) and that at Chott Merouane requiring confirmation (Bensaci *et al.* 2010). We report here on nesting events and ringing efforts in 2011–13.

Methods

Four wetlands (El Goléa and Safioune, in the Sahara, and Ezzemoul and Bazer Sakra, in the eastern Hauts Plateaux) were monitored in 2011–13, with observations being made using telescopes (× 60) from the lakes' shores. Close to hatching, the colonies were approached to 50–100 m, using a hide, and any Darvic rings worn by Greater Flamingos were recorded. Prior to fledging, chicks were 'herded' into a specially built corral and banded with colour plastic rings bearing unique codes.

Results

In 2011, Greater Flamingos bred at Safioune and Ezzemoul. Nearly 10,000 ring resightings were recorded at various localities across the Sahara and the Algerian Hauts Plateaux indicating that birds breeding at the two sites originated from colonies throughout the Mediterranean basin. In 2012–13, the species did not attempt breeding because of drought, except at Safioune, where the attempt was unsuccessful.

Safioune (Sahara)

After two nesting attempts, in May and September 2010, the flamingos finally settled on a sandy dyke in the northern part of the sebkha in late December 2010. Flooding thwarted the first

Figure 1. Partial view of the Greater Flamingo *Phoenicopterus roseus* colony at Safioune in 2011 (Boudjéma Samraoui)

Vue partielle de la colonie de Flamants roses *Phoenicopterus roseus* de Safioune en 2011 (Boudjéma Samraoui)

Figures 2–3. The ringing operation at Safioune in 2011 (Boudjéma Samraoui)

L'opération de baguage à Safioune en 2011 (Boudjéma Samraoui)

birds to attempt breeding, and by 29 January just two chicks survived. Thereafter, the colony of 1,500 pairs retreated to higher ground and nested in groups along the dyke. In the first week of April incubation in some groups was virtually completed, whereas others were just starting, while a developing crèche held 600 chicks, some of them nearly two months old (Fig. 1). In mid April, the

Figure 4. Partial view of the breeding colony at Ezzemoul in 2011 (Boudjéma Samraoui)

Vue partielle de la colonie de Flamants roses *Phoenicopterus roseus* de Ezzemoul en 2011 (Boudjéma Samraoui)

Figures 5–6. The ringing operation at Ezzemoul in 2011 (Boudjéma Samraoui)

L'opération de baguage à Ezzemoul en 2011 (Boudjéma Samraoui)

low water level surrounding the dyke permitted a group of Golden Jackals *Canis aureus* to enter the colony, which was consequently deserted. More than 20 chicks and six adults were killed, and >350 eggs abandoned. On 23 April, 60 volunteers coaxed a fraction of the remaining crèche towards a corral and 62 chicks were measured and ringed (Figs. 2–3).

The 2012 breeding attempt failed in part because of drought. Approximately 6,000 birds were present and dozens of pairs started incubating in late December, and by the end of January the first chicks hatched. However, strong winds displaced the shallow water surrounding the dune mounds where the colony had established, again permitting Golden Jackals to access the area. Although most adults apparently remained at the site, they did not breed again. In 2013, despite the drought, flamingos attempted to breed in early January, but the water around the mounds did not persist for long and they soon deserted.

Figure 7. Installing artificial nests and wooden decoys of adult flamingos at Bazer Sakra in 2011 (Boudjéma Samraoui)
L'installation de nids en ciment et de modèles en bois de flamants roses à Bazer Sakra en 2011 (Boudjéma Samraoui)

Ezzemoul (Hauts Plateaux)

Following sparse rainfall in winter, the saline lake complex of Oum El Bouaghi was relatively dry in spring 2011. Rain in early May prompted the flamingos to visit the islet at Ezzemoul where nesting had previously occurred. From 12 May, the islet was occupied by nesting Slender-billed Gulls *Larus genei* and Pied Avocets *Recurvirostra avosetta*. On 19 May, 50 pairs of Greater Flamingo began incubating on the west side of the islet, gradually displacing the gulls. The number of pairs increased steadily; by 2 June there were 3,000 pairs and subsequently *c.*4,500 pairs (Fig. 4). Most of the breeding adults foraged in an adjacent lagoon, Chott Tinsilt, although some were recorded elsewhere (Tarf, Chott Gadaïne, Bazer Sakra). Chicks were starting to leave their nests on 22 June and a crèche began to form in the days that followed. Five Egyptian Vultures *Neophron percnopterus* predated the colony, but concentrated mainly on eggs and small (or already dead?) chicks. On 30 July, part of the crèche comprising 3,500 chicks was gently 'herded' into a corral and 895 chicks were measured and ringed (Figs. 5–6). Despite the drought, at least 70% of the ringed chicks fledged. In 2012–13, Ezzemoul was dry and breeding was not attempted.

Bazer Sakra (Hauts Plateaux)

In early April 2011, despite the water level at Bazer Sakra being just 20 cm, artificial nests and wooden decoys of adults were installed in the centre of the sebkha, 1.4 km from the shore. At this site, previous breeding attempts, all of which occurred close to the lake's shores, failed mainly because of disturbance by people and domestic animals. The decoy location was chosen based on a nesting attempt in summer 2010 (Bouchibi Baaziz *et al.* 2010). A total of 21 nest mounds based on two large piles of cement and mud were installed by ten volunteers. Each mound, weighing 12–13 kg, had a width of 40 cm and a height of 13 cm. Six wooden decoys of adult flamingos were also installed (Fig. 7).

Numbers of flamingos increased from 200 in April to 2,850 in May, but nesting did not start until 11 July, when 2,500 flamingos concentrated in the middle of the sebkha, with 350 individuals at the artificial mounds and decoys. The birds built 130 nests at a distance of 240 m from the artificial site. Incubation was inexplicably interrupted several times before the attempt was terminated 12 days later. During this breeding effort, *c.*600 flamingos were faithful to the artificial mounds, remaining slightly apart from the main colony, which increased to a max.

2,750 individuals. In 2012–13, Bazer Sakra was dry and breeding was not attempted.

Chott Chergui (Hauts Plateaux)

Old Greater Flamingo nests were discovered in June 2012, on an islet at Sebkhet El Gara (34°06.679'N 00°30.816'E) in the Chott Chergui, a vast salt lake of 855,500 ha that is adequately surveyed only from the air. At that time only Slender-billed Gulls, Gull-billed Terns *Gelochelidon nilotica*, Black-winged Stilts *Himantopus himantopus*, Pied Avocets and Kentish Plovers *Charadrius alexandrinus* were breeding.

El Goléa (Sahara)

In early March 2011, 550 flamingos started nest building but breeding was interrupted three weeks later for no apparent reason, by which time 37 nests had been constructed and just a single egg laid. In 2012–13, the birds settled on one of the islets and *c.*20 adults attempted to breed, but the effort failed in early May.

Discussion

Greater Flamingo twice bred successfully in Algeria in 2011 with a total of 4,100 chicks fledging at the two sites (3,500 at Ezzemoul and 600 at Safioune). Two other nesting attempts at two additional sites (Bazer Sakra and El Goléa) failed because of drought. Over the last 11 years (2003–13), 25 nesting attempts have occurred in Algeria, six of them at three sites, Ezzemoul, El Goléa and Safioune, producing a total of 19,323 fledglings. The intensive ring resighting effort over the last ten years, and molecular data, have confirmed the connectivity of the various Algerian colonies, with birds switching breeding site across the country and throughout the Mediterranean basin (Boucheker *et al.* 2011, Geraci *et al.* 2012). The number of breeding attempts, the frequency of successful efforts, and the first successful breeding in Europe of a flamingo originating from North Africa, confirm that Algeria can be considered part of the species' main breeding range in the Mediterranean basin; the same data support the hypothesis of a North African origin for European colonies (Samraoui *et al.* 2010).

Sahara

In 2011, successful breeding occurred for the first time at Safioune suggesting that the previous attempt in the Sahara at El Goléa (Bouzid *et al.* 2009) was not an exceptional event. Safioune, unlike El Goléa, is not only fed by flood water but also from the drainage system of Ouargla oasis and, because of its location, has the potential to become an important breeding site, being relatively free from human disturbance. The low water levels at El Goléa may have prevented the species from breeding in 2011–13, but it is also the case that Safioune attracted some of those adults that had previously bred at El Goléa. Those flamingos that were present at El Goléa may have been mostly young birds incapable of breeding, despite intensively displaying in late winter.

Hauts Plateaux

Ezzemoul, in the Hauts Plateaux, has become one of the most important breeding sites in the western Mediterranean, both in terms of the number of breeding pairs (4,500–12,000) and frequency of occupation (nine nesting attempts in the last ten years, four of them successful). In the neighbouring wetland complex of Bazer Sakra, successful breeding has not yet occurred, despite use of nest mounds and decoys, techniques that have yielded success elsewhere (Stevens 1991, Rendon-Martos & Johnson 1996, O'Connell-Rodwell *et al.* 2004, McAlpin 2010). However, the prevailing drought in recent years has been a major constraint. The newly discovered nesting site in the Chott Chergui extends the breeding range of Greater Flamingo in Algeria and we believe that further breeding attempts can be expected at this huge salt lake.

Successful breeding at natural sites in North Africa, as elsewhere, is clearly dependent on local conditions as low water levels permit predators such as jackals, feral dogs and Wild Boars *Sus scrofa* to access the colonies. Human disturbance also is a threat to flamingo colonies although protection of breeding sites may constitute a palliative solution in the absence of full public awareness (Béchet & Samraoui 2010).

Acknowledgements

We are most grateful to Ron Demey and two anonymous referees for their comments and helpful suggestions. We also thank the numerous students of the Laboratoire de Recherche et de Conservation des Zones Humides, who generously helped in several ways. The study was conducted under the auspices of

the Algerian DGRSTD / MESRS. We are most grateful to Luc Hoffmann, the MAVA Foundation, the Station Biologique de la Tour du Valat, Distinguished Scientist Fellowship program, King Saud University (Saudi Arabia) and the Benamor Group for material help.

References

Béchet, A. & Samraoui, B. 2010. *Plan d'action pour le Flamant rose Phoenicopterus roseus en Algérie.* Arles: Centre de recherche de la Tour du Valat.

Bensaci, E., Bouzegag, A., Guerguerb, E., Bounab, C., Brahmia, H., Nouidjem, Y., Zeraoula, A., Bouaguel, L., Saheb, M., Metallaoui, S., Mayache, B., Bouslma, Z. & Houhamdi, M. 2010. Chott Merouane (Algérie): un nouveau site de reproduction du Flamant rose *Phoenicopterus roseus*. In Lee, R., Arengo, F. & Béchet, A. (eds.) *Flamingo, Bull. IUCN-SSC/Wetlands International Flamingo Specialist Group* 18: 40–47.

Boucheker, A., Samraoui, B., Prodon, R., Amat, J. A., Rendon-Martos, M., Baccetti, N., Vidal i Esquerre, Nissardi, S., Balkiz, Ö., Germain, C., Boulkhssaim, M. & Béchet A. 2011. Connectivity between the Algerian population of Greater Flamingo *Phoenicopterus roseus* and those of the Mediterranean basin. *Ostrich* 82: 167–174.

Bouchibi Baaziz, N., Bouzid, A., Boulkhssaim, M., Ouldjaoui, A., Baaziz, N., Boucheker, A. & Samraoui, B. 2010. A new nesting site for the Greater Flamingo *Phoenicopterus roseus* in the Algerian Sahara and an account of the 2010 breeding season. In Lee, R., Arengo, F. & Béchet, A. (eds.) *Flamingo, Bull. IUCN-SSC/Wetlands International Flamingo Specialist Group* 18: 71–75.

Bouzid, A., Yousfi, A., Boulkhssaim, M. & Samraoui, B. 2009. Première nidification réussie du Flamant rose *Phoenicopterus roseus* dans le Sahara algérien. *Alauda* 77: 139–143.

Geraci, J., Béchet, A., Cézilly, S., Baccetti, N., Samraoui, B. & Wattier, R. 2012. Greater flamingo colonies around the Mediterranean form a single interbreeding population and share a common history. *J. Avian Biol.* 43: 341–354.

Johnson, A. & Cézilly, F. 2007. *The Greater Flamingo.* London, UK: T & A.D. Poyser.

McAlpin, L. 2010. The use of mirrors and artificial nest mounds to encourage breeding in Chilean Flamingos *Phoenicopterus chilensis* at Colchester Zoo. In: Lee, R., Arengo, F. & Béchet, A. (eds.) *Flamingo, Bull. IUCN-SSC/Wetlands International Flamingo Specialist Group* 18: 67–70.

O'Connell-Rodwell, Rojek, N., Rodwell, T. C. & Shannon, P. W. 2004. Artificially induced group display and nesting behavior in a reintroduced population of Caribbean Flamingo *Phoenicopterus ruber ruber. Bird Conserv. Intern.* 14: 55–62.

Rendon Martos, M. & Johnson, A. 1996. Management of nesting sites for Greater Flamingos. *Colonial Waterbirds (Spec. Publ.)* 19: 167–183.

Samraoui, B., Ouldjaoui, A., Boulkhssaïm, M., Houhamdi, M., Saheb, M. & Béchet, A. 2006. The first recorded reproduction of the Greater Flamingo *Phoenicopterus roseus* in Algeria: behavioural and ecological aspects. *Ostrich* 77: 153–159.

Samraoui, F., Boulkhssaïm, M., Bouzid, A., Baaziz, N., Ouldjaoui, A., Boucheker, A. & Samraoui, B. 2010. La reproduction du Flamant rose *Phoenicopterus roseus* en Algérie (2003-2009). *Alauda* 78: 15–25.

Stevens, E. F. 1991. Flamingo breeding: the role of group displays. *Zoo Biol.* 10: 53–64.

[a] *Laboratoire de Recherche des Zones Humides, Department of Biology, University of Guelma, Algeria. E-mail: bsamraoui@yahoo.fr*

[b] *Département de biologie, Université de Constantine, Algeria.*

[c] *Institut de biologie, Université d'Oum El Bouaghi, Algeria.*

[d] *Département de Sciences Agronomiques, Université d'Ouargla, Algeria.*

[e] *Département de Biologie, Université d'El Tarf, Algeria.*

[f] *Center of Excellence for Research in Biodiversity, King Saud University, Riyadh, Saudi Arabia.*

Received 26 September 2013; revision accepted 19 March 2014.